CLAIMS

1. A heat exchanger header tank comprising a header forming plate, a tube connecting plate and an intermediate plate interposed between the two plates, the header forming plate, the tube connecting plate and intermediate plate being arranged in superposed layers and brazed to one another, the header forming plate being provided with an outward bulging portion extending longitudinally thereof and having an opening thereof closed with the intermediate plate, the tube connecting plate being provided at a portion thereof corresponding to the outward bulging portion with a plurality of tube insertion holes arranged longitudinally of the tube connecting plate at a spacing and extending through the thickness thereof, the intermediate plate having communication holes extending through the thickness thereof for causing the respective tube insertion holes of the tube connecting plate to communicate with interior of the outward bulging portion of the header forming plate therethrough.

2. A heat exchanger header tank according to claim 1 wherein the header forming plate, the tube connecting plate and the intermediate plate are each made from a metal plate by press work.

3. A heat exchanger header tank according to claim 1 wherein the tube connecting plate is integrally provided at each of opposite side edges thereof with a cover wall covering a boundary between the header forming plate and the intermediate plate over the entire length thereof, and the cover wall is brazed to corresponding side faces of the header forming plate and

the intermediate plate.

4. A heat exchanger header tank according to claim 3 wherein the cover plate is integrally provided at an outer end thereof with an engaging portion engaged with an outer surface of the header forming plate and brazed to the header forming plate.

5. A heat exchanger header tank according to claim 1 wherein the header forming plate has one outward bulging portion, and all the communication holes of the intermediate plate are held in communication by communication portions formed in the intermediate plate.

6. A heat exchanger header tank according to claim 1 wherein the header forming plate has a plurality of outward bulging portions aligned longitudinally thereof and spaced apart from each other, and all the communication holes of the intermediate plate communicating with each of the outward bulging portions are held in communication by communication portions formed in the intermediate plate.

7. A heat exchanger header tank according to claim 1 wherein the header forming plate has a plurality of outward bulging portions arranged widthwise thereof and spaced apart from each other, and all the communication holes of the intermediate plate communicating with each of the outward bulging portions are held in communication by communication portions formed in the intermediate plate.

8. A heat exchanger header tank according to claim 1 wherein the header forming plate has a plurality of outward bulging portions arranged longitudinally and widthwise thereof and spaced from one another, and the communication holes of the

intermediate plate communicating with at least one group of outward bulging portions arranged in the widthwise direction are held in communication by first communication portions formed in the intermediate plate to thereby cause the outward bulging portions of the group to communicate with one another, all the communication holes of the intermediate plate communicating with the other outward bulging portions being held in communication by second communication holes formed in the intermediate plate.

9. A heat exchanger comprising a pair of header tanks arranged as spaced apart from each other, and a plurality of heat exchange tubes arranged in parallel between the pair of header tanks and each having opposite ends joined to the respective header tanks,

each of the heat exchanger header tanks comprising a header forming plate, a tube connecting plate and an intermediate plate interposed between the two plates, the header forming plate, the tube connecting plate and intermediate plate being arranged in superposed layers and brazed to one another, the header forming plate being provided with an outward bulging portion extending longitudinally thereof and having an opening thereof closed with the intermediate plate, the tube connecting plate being provided at a portion thereof corresponding to the outward bulging portion with a plurality of tube insertion holes arranged longitudinally of the tube connecting plate at a spacing and extending through the thickness thereof, the intermediate plate having communication holes extending through the thickness thereof for causing the respective tube insertion

holes of the tube connecting plate to communicate with interior of the outward bulging portion of the header forming plate therethrough, the heat exchange tubes having their opposite ends inserted into the respective tube insertion holes of the pair of header tanks and brazed to the respective header tanks.

10. A heat exchanger according to claim 9 wherein the header forming plate, the tube connecting plate and the intermediate plate are each made from a metal plate by press work.

11. A heat exchanger according to claim 9 wherein the tube connecting plate is integrally provided at each of opposite side edges thereof with a cover wall covering a boundary between the header forming plate and the intermediate plate over the entire length thereof, and the cover wall is brazed to corresponding side faces of the header forming plate and the intermediate plate.

12. A heat exchanger according to claim 11 wherein the cover plate is integrally provided at an outer end thereof with an engaging portion engaged with an outer surface of the header forming plate and brazed to the header forming plate.

13. A heat exchanger according to claim 9 wherein the header forming plate of the first of the pair of header tanks has a plurality of outward bulging portions aligned longitudinally thereof and spaced apart from each other, and the header forming plate of the second of the pair of header tanks has outward bulging portions one smaller in number to the number of outward bulging portions of the first header tank so as to be opposed to adjacent two outward bulging portions

of the first header tank,

all the communication holes of the intermediate plate of the first header tank in communication with each of the outward bulging portions of the first header tank being held in communication by communication portions formed in the intermediate plate,

all the communication holes of the intermediate plate of the second header tank in communication with each of the outward bulging portions of the second header tank being held in communication by communication portions formed in the intermediate plate,

the first header tank having a refrigerant inlet communicating with the outward bulging portion at one end thereof and a refrigerant outlet communicating with the outward bulging portion at the other end thereof.

14. A heat exchanger according to claim 13 wherein the first header tank is two in the number of outward bulging portions therein, and the second header tank is one in the number of outward bulging portion therein.

15. A heat exchanger according to claim 13 wherein assuming that the header forming plate of each of the header tanks has a wall thickness T and that the outward bulging portion of each header tank has a bulging height of H, H/T is in the range of 0.5 to 1.5.

16. A heat exchanger according to claim 9 wherein the header forming plate of the first of the pair of header tanks has four outward bulging portions arranged widthwise thereof at a spacing and longitudinally thereof at a spacing, and

the header forming plate of the second of the pair of header tanks has two outward bulging portions arranged side by side as spaced apart widthwise thereof and opposed to the respective longitudinally adjacent pairs of outward bulging portions of the first header tank,

the tube connecting plate of each of the header tanks being provided with a plurality of tube insertion holes at each of widthwise opposite side portions thereof, the intermediate plate of each header tank being provided with a plurality of communication holes at each of widthwise opposite side portions thereof,

the communication holes of the intermediate plate of the first header tank in communication with one of the pair of outward bulging portions arranged widthwise of the first header tank and the communication holes of the intermediate plate in communication with the other outward bulging portion of said pair being held in communication by first communication holes formed in the intermediate plate to thereby cause said pair of outward bulging portions to communicate with each other, all the communication holes of the intermediate plate communicating with the other pair of outward bulging portions being held in communication by second communication portions formed in the intermediate plate,

all the communication holes of the intermediate plat of the second header tank in communication with each of the outward bulging portions of the second header tank being held in communication by communication portions formed in the intermediate plate,

the first header tank being provided with a refrigerant inlet communicating with one of said other pair of outward bulging portions and a refrigerant outlet communicating with the other outward bulging portion of said other pair.

17. A heat exchanger according to claim 16 wherein assuming that the header forming plate of each of the header tanks has a wall thickness T and that the outward bulging portions of each header tank have a bulging height of H, H/T is in the range of 1.0 to 2.0.

18. A process for fabricating a heat exchanger characterized by:

subjecting a brazing sheet having a brazing material layer over at least one surface thereof to press work to make a header forming plate having an outward bulging portion with an inner surface thereof covered with the brazing material layer,

making a tube connecting plate having a plurality of tube insertion holes arranged longitudinally thereof at a spacing, a cover plate integral with each of opposite side edges thereof and extending over the entire length thereof and an engaging portion forming lug integral with an outer end of the cover wall, by subjecting a brazing sheet having a brazing material layer over opposite surfaces thereof to press work,

making an intermediate plate having a plurality of communication holes arranged longitudinally thereof at a spacing by subjecting a bare metal material to press work,

making two tacked assemblies each by arranging the three plates in superposed layers with the intermediate plate positioned in the middle, inwardly bending the engaging portion

forming lug to form an engaging portion and causing the engaging portion to engage with the header forming plate to tack the three plates,

preparing a plurality of heat exchange tubes and fins,

arranging the two tacked assemblies as spaced apart with the tube connecting plates opposed to each other,

alternately arranging the heat exchange tubes and the fins,

placing opposite ends of the heat exchange tubes into the respective tube insertion holes of the tube connecting plates of the two tacked assemblies, and

brazing the three plates of each of the tacked assemblies to one another to make header tanks, brazing the cover wall of each tacked assembly to corresponding side faces of the header forming plate and the intermediate plate thereof and the engaging portion thereof to the header forming plate, and brazing the heat exchange tubes to the header tanks and each of the fins to the heat exchange tubes adjacent thereto at the same time.

19. A supercritical refrigeration cycle which comprises a compressor, a gas cooler, an evaporator, a pressure reducing device and an intermediate heat exchanger for subjecting refrigerant flowing out from the gas cooler and refrigerant flowing out from the evaporator to heat exchange, and wherein a supercritical refrigerant is used, the gas cooler comprising a heat exchanger according to any one of claims 13 to 15.

20. A supercritical refrigeration cycle which comprises a compressor, a gas cooler, an evaporator, a pressure reducing device and an intermediate heat exchanger for subjecting

refrigerant flowing out from the gas cooler and refrigerant flowing out from the evaporator to heat exchange, and wherein a supercritical refrigerant is used, the evaporator comprising a heat exchanger according to claim 16 or 17.

21. A vehicle having installed therein a supercritical refrigeration cycle according to claim 19 as a vehicle air conditioner.

22. A vehicle having installed therein a supercritical refrigeration cycle according to claim 20 as a vehicle air conditioner.